

Research Highlight

Atmospheric aerosols play a significant role in the Earth's environment. Besides adversely affecting air quality and human health, aerosols can also influence our weather and climate by altering solar radiation and clouds. Understanding the impacts of aerosols is, however, no easy task, as it depends on the chemical composition and physical properties of aerosols, which can be very different from one region to another. It is therefore necessary for scientists to measure the characteristics of aerosols in different regions around the world.

Several different platforms are used to measure aerosols, with each having strengths and weaknesses. Satellites can provide global coverage, but lack detailed information needed by scientists. Instruments on the ground can provide some details, but cannot resolve the vertical distribution of aerosols in the atmosphere, which can be an important factor determining their effects. Aircraft can make detailed measurements of aerosols at different levels of the atmosphere. But few aircraft experiments have been conducted in some of the most polluted regions in the world, including China, in spite of the strong potential effects of aerosols from those regions on the environment.

In a study sponsored by the Department of Energy, researchers reported results from one of the first aircraft experiments for measuring aerosols over northern China. The aim of this study was to gain insights into the physical properties of aerosols in the region and how weather systems influence the makeup of aerosols. During the two-week experiment, scientists conducted several flights to measure the light scattered by the aerosols from near the surface to about 4 kilometers, using an instrument called the nephelometer. They also measured sulfur dioxide (SO₂), which comes from pollution sources and can form aerosols in the atmosphere.

One finding from this study is that aerosols in the region are very complex, in the sense that they include both dust from the nearby deserts and pollutants from the numerous power plants, factories, and residences in the area. In comparison, aerosols over the eastern U.S. are mainly from pollution sources. As a result, the overall size of aerosols over northern China is much greater than over the eastern U.S. (see figure), because dust aerosols are generally bigger than pollution aerosols. On top of that, the makeup of aerosols in northern China also depends on weather conditions and height. More pollution aerosols were observed before cold fronts passed through the region, and more dust aerosols were observed after that. As the aircraft climbed to greater altitudes, more dust and less pollution were measured. All these reveal a highly dynamic, complex picture of aerosols in northern China.

Data from this study can be used by scientists to provide more accurate estimates of the effects of aerosols on air quality and climate. While the scope of this study is limited to one field experiment, it constitutes an important first step towards better understanding the regional and global impacts of aerosols from China.

Reference(s)

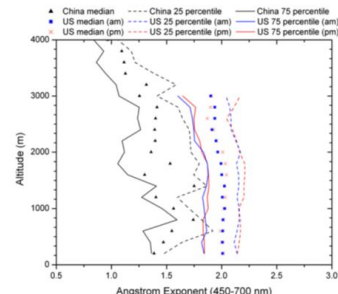
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Working Group(s)

Aerosol Life Cycle



Altitude profiles of Ångström exponents observed from aircraft flights over eastern China in spring and over the eastern U.S. in summer. The Ångström exponents can be viewed as an indicator of the size of aerosols, with smaller values corresponding to larger overall size of aerosol particles. The figure reveals significantly different properties of aerosols between the two regions.